Mercury Solids Sampling Project & Next Steps

Arline Seeger & Laura Kinner NLA Environmental Committee Meeting November 3, 2011

Western Lime Solids Sampling & Stack Testing

- Coal primary source of Hg
- Stone's (& lime's) Hg content is negligible
- Less Hg in LKD = More Hg to atmosphere
- Straight kiln retained 85% of Hg in the LKD, vs. 10% for the preheater

Unresolved

- Whether difference in Hg emissions from the two kiln systems is a result of
 - Heat exchanger upfront of straight kiln
 - Difference in baghouse systems (type & filter media)
 - Difference in LKD generation rate & unburned carbon, Cl and S content

Agreed upon Next Steps

- This summer, lime MACT major sources were to have conducted solids sampling
 - NLA negotiated rate
- Solids sampling instructive regarding:
 - Hg loading to the kilns
 - Hg retention (in LKD)
 - Which plants will drive MACT floor

NLA Member

Lime MACT Major Sources

- Ten NLA members
 - 26 plants (excludes inactive plants)
- 84 rotary kilns (excludes kilns at inactive plants)
 - 43 pre-heater, all baghouse-equipped
 - 41 straight
 - 24 w/ baghouses
 - 12 w/ scrubbers
 - 5 w/ ESPs

Project Status

- Two members completed assignment on time !
- Remainder
 - Most have 4 weeks of data for most of their kilns
 - For kilns w/ similar characteristics (same kiln type, fuel, APCD), samples obtained for representative kiln
- No data on 9 plants
- No data on wet scrubber-equipped kiln

Hg Results (ppb): Stone & Fuel

	Average	Range	Median
Stone	2.6	0.3 to 26	1
Coal	102	18 to 546	58
Coke	10	0.6 to 33	6.5
Solid Fuel	62	7 to 197	103





Mercury & Sulfur in Solid Fuel by Kiln Type



Mercury in Coal vs Sulfur in Coal



Adsorption by LKD/Other Factors

Hg in LKD Overview

- Preheater vs Straight kilns : Hg content of Coal and LKD (next slide)
- Nearly 40% kilns generate LKD w/very little Hg
 - < 4 ppb in 1/3 preheaters & 1/2 straight kiln
 - Straight kilns smaller data set, and no wet scrubber equipped kilns
- Average: 33 ppb
 - Preheater: 22 ppb
 - Straight: 54 ppb

Hg in Coal and LKD by Kiln Type





Hg in LKD (16 Straight Kilns)



% Hg Retained

- Better indicator of adsorption (than Hg in LKD) because it takes into account Hg loading to the system
- = TPE (stone & fuel inputs) Estimated air emissions/TPE
 * 100
- Nearly 40% of kilns have insignificant % Hg retained
 - < 4 % Hg retained for 1/3 preheaters & ½ straight kilns (smaller data set, no wet scrubber-equipped kiln)
- Average = 16%
 - Preheater: 13% (same as median)
 - Straight: 19% (median is 4%)

Percent Mercury Retained (28 Pre-Heater Kilns)







Percent Hg Retained vs Unburned Carbon Content

Major Source Baghouse Parameters

Baghouse Parameters

- 65 rotary kilns: 46 preheater, 19 straight
- Two-thirds of baghouses are pulse jet (43 kilns)
 10 preheater kilns are RA, and 12 straight kilns
- Virtually all have membrane bags (59 kilns)
- Post Lime MACT I data will result in significant lowering of PM standard due to shift in bag type
- APCD inlet temp to vague (e.g., < 500) or too broad (400 to 500) to derive meaningful stats
- Air-to-cloth ratio responses need refinement

Recent Stack Testing

Stack Testing Protocol ReCap

- EPA Method 30B (Sorbent Trap Method)
 - Three one hour runs, unless runs highly variable
 - Paired Runs
- Concurrent Speciated Testing (single not paired)
- Solids to be Sampled on Test Day !!

		Hg in Fuel (ppb)	% Hg Retained in LKD	Lbs Hg/ MM ton lime	Pre-test Estimate
Straight	Dolo (WLC)	40	85	1	1
	Dolo	39	1.5	66	40
	Dolo	260	0.3	184	171
Pre heater	Dolo (WLC)	40	13	14	10
	Hi-cal	181	16	52	67 (5 samples)
	Hi-cal	106	14	86	33 (5 samples)

		% Elemental
Straight	Dolo (WLC)	>80%
	Dolo	25%
	Dolo	25%
Preheater	Dolo (WLC)	>80%
	Hi-cal	20%
	Hi-cal	30%

Room for Improvement

- APCD Inlet Temp
- LKD Generation Rate
- Don't Forget to Sample Solids on Test Day
- Asking plant operators to send data to NLA/contractors does not generally equate to getting it done

MACT Floor Candidates

Based on Pre-Test Estimates

- Non-coal fired kilns
 - Gas/coke fired: < 1 lb/MM ton lime
 - No data on solely gas-fired kilns
 - Separate subcategory & work practice (just like boilers)
- Coal & coal/coke fired-boilers: pre-test estimates in lbs/MM ton lime
 - Eden straight rotary: 1 to 3
 - 3 PH kilns w/ APCD inlets < 400F: 6, 8 & 11
 - 2 PH kilns w/ substantial % coke: 8 & 11
 - Straight rotary w/ low Hg& very high Cl in coal & 55% Hg retention: 11

Crystal Ball: MACT Floor for Solid Fuel-Fired Kilns

Kiln Type by Solid Fuel Burned	No. Kilns in MACT Pool thus far	MACT Floor	
		No. Kilns	Lb/MM ton lime*
All solid fuel-fired kilns	43	5	3.9
All solid fuel fired kilns minus gas/coke fired kiln	42	5	6.1
All coal-fired kilns	28	3	5.3
All solely coal & coke -fired kilns	14	2 (same plant)	9.7

* Values likely to more than double when statistical manipulation performed to account for variability

To Test or Not to Test?

- If scant data received in ICR responses , EPA will compel testing
 - Tests done in haste often more expensive & flawed
- Ash grove-like headlines unlikely
 - Ashgrove emissions: > one ton (3rd largest U.S. Source)
- Pre-test estimates for lime plants suggest emissions 3 times TRI lime industry total (900 vs 300 lbs/year)
- 1998 EPA Lime Industry Hg Emissions Estimate
 - 1400 lbs (0.4% national emissions)
 - Basis for EPA decision to not regulate area sources at lime plants

To Test or Not to Test (cont'd)

- Average lime plant production: 385,000 short tons
 - At 45 lbs Hg/MM ton lime, about 17 lbs/year
- Potential MACT floor candidates warrant thorough evaluation under full range of operating conditions

Other Ramifications/Considerations

- Examine whether TRI solid releases data for unsold LKD warrant different EF next year
- Air Dispersion Modeling for Sources w/ high predicted estimates & worse stack characteristics

Recap & Discussion

- Thus far, limestone not significant source of Hg
 - Bodes well for boiler-like approach to MACT standard
 - Data on all plants (esp. scrubber-equipped kilns) needed, consistent w/ protocol
- Never too early to start developing Hg strategy
 - Actual stack testing would help in most cases
- Recommend to Board at February meeting air dispersion modeling for plant(s)of interest